
האיגוד הישראלי לעמוד השדרה
ISRAEL SPINE SOCIETY
The 21th Annual Meeting of the Israel Spine Society
17-19 June 2021 Thursday
Isrotel Kedma Hotel, Sde Boker, Israel

# GENERAL INFORMATION

**The 21th annual meeting of the Israel Spine Society will be held on Thursday-Saturday, 17th - 19th June, 2021 "Kedma" Hotel in Sde Boker.**

## Acting Committee

Gad J. Velan M.D
Chairman

Eyal Yitzchayek M.D
Secretary

Yoram Anekstein M.D
Treasurer

Ran Harel M.D
Scientific officer

Joshua Schroeder M.D
Member at large

## Conference Secretary

Mrs. Shanit Twito

## Official Language

The official language will be Hebrew. Certificate of attendance will be provided upon request. Throughout the duration of the meeting, exhibits stands will display spine surgery systems, pharmaceutical and medical products.

## Dress code

Casual

# SCIENTIFIC PROGRAM

## THURSDAY (17TH JUNE 2021)

10:00 - 10:05
WELCOME NOTE
G.Velan

SESSION 1: MIS
CHAIRMEN: R. HAREL, E. ITZCHAYEK

10:06 - 10:15
(1.1) MINIMALLY INVASIVE DISCECTOMY VERSUS OPEN LAMINECTOMY AND DISCECTOMY FOR THE TREATMENT OF CAUDA EQUINA SYNDROME: A CASE CONTROL STUDY..
G.J. Regev, A. Grundshtein, M. Khashan, B. Kuzmenko, D. Ofir, K. Salame, D. Niry, Z. Lidar

10:16 - 10:25
(1.2) OUR INITIAL EXPERIENCE WITH XLIF CASES- CLINICAL AND RADIOLOGICAL OUTCOME.
R. Masarwa, U. Ofir, Y. Steinfeld, A. Yassin, Y. Folman, E. Behrbalk

10:26 - 10:35
(1.3) LONG TERM PAIN CHARACTERISTICS AND MANAGEMENT FOLLOWING MINIMALLY INVASIVE SPINAL DECOMPRESSION AND OPEN LAMINECTOMY AND FUSION FOR SPINAL STENOSIS.
G.J. Regev, G. Leor, U. Hochberg, R. Ankori, D. Ofir, K. Salame, M. Khashan, R. Kedem, Z. Lidar

10:36 - 10:45
(1.4) PERCUTANEOUS ENDOSCOPIC DISCECTOMY CLINICAL AND SURGICAL OUTCOMES, A SINGLE-CENTER EXPERIENCE
S. Yassin, S. Harnof, S. Davidovich, S. Jackson, D. Cogan, A. Hasharoni ,E. Itshayek

10:46 - 10:55
(1.5) RESECTION OF EXTRADURAL TUMORS OF THE SPINE IN PEDIATRIC POPULATION BY MINIMALLY INVASIVE TECHNIQUES
Z. Lidar, D. ofir, G.J. Regev, M. Khashan, K. Salame

10:56 - 11:05
(1.6) DOES TOBACCO SMOKING AFFECT THE POST-OPERATIVE OUTCOME OF MIS LUMBAR DECOMPRESSION SURGERY?
D. Ofir, M. Khashan, G. Regev, K. Salame, L. Mangel ,Z. Lidar

11:06 - 11:11
DISCUSSION

11:12 - 11:21
(1.7) VERTEBRAL OSTEOPOROTIC FRACTURES. A TREATMENT-BASED COMPARISON OF MORTALITY
A. Zohar, I. Getzler, A. Shpigelman, A. Suliman, V. Alexandrovsky, B. Bernfeld

11:22 - 11:31
(1.8) COST-BENEFIT ANALYSIS OF ROUTINE BONE BIOPSY DURING AUGMENTATION OF OSTEOPOROTIC VERTEBRAL COMPRESSION FRACTURES
O. Hershkovich, E. Bayley, O. Rudik, V. Alexandrovsky, A. Friedlander, E. Daglen, R. Lotan

11:32 - 11:41
(1.9) KYPHOPLASTY FOR ELDERLY PATIENTS WITH VERTEBRAL COMPRESSION FRACTURES - DO WE SAVE LIVES?
R. Lotan, Y. Smorgick, Y. Anekstein, O. Rudik, I. Prosso, O. Hershkovich

11:42 - 11:51
(1.10) THE TREATMENT OF PAINFUL VERTEBRAL FRACTURES UNDER LOCAL ANESTHESIA
S. Josh, L. Kaplan, S. Sagiv, J. Cohen

11:52 - 12:17
PANEL DISCUSSION: MIS VS.OPEN APPROACH FOR DEGENERATIVE SPINAL PATHOLOGIES
Moderator: A. Hasharoni
Participants: E. Behrbalk, E. Hadad, G. Regev, O. Hershkovich, N. Rachamimov

12:18 - 12:58
LUNCH BREAK

# SCIENTIFIC PROGRAM

## SESSION 2: CERVICAL
## CHAIRMEN: I. ENGEL, R. DEJEBAROV

12:59 - 13:08
(2.1) EPIDEMIOLOGY OF OPLL IN THE JEWISH POPULATION IN ISRAEL: A RADIOGRAPHIC AND CLINICAL ANALYSIS
G. Kimchi, N. Knoller, T. Maimon, L. L. Geva, A. Peled, G. Yaniv, R. Harel

13:09 - 13:18
(2.2) MULTI CERVICAL REHABILITATION UNIT IMPROVES RANGE OF MOTION AND CERVICAL SPINE MUSCLE STRENGTH IN AVIATORS WITH CERVICALGIA – A RETROSPECTIVE ANALYSIS
Y. Barzilay, N. Kahana, N. Y. Frenkel, B. Gordon, L. Gavish

13:19 - 13:28
(2.3) INTEGRITY OF THE TECTORIAL MEMBRANE IS A FAVORABLE PROGNOSTIC FACTOR IN ATLANTO-OCCIPITAL DISLOCATION
G. Kimchi, N. Knoller, R. Harel

13:29 - 13:38
(2.4) CENTRAL CORD SYNDROME IN A YOUNG MALE NOVICE SURFERS
I. Trior, E. hadad, Y. Keren, Y. steifeld, S. Vider, L. Merom, K. Hamud, O. Keynan

13:39 - 13:48
(2.5) SPINAL AVF: SURGICAL CONSIDERATION WHEN ANGIOGRAPHY IS MISLEADING.
R. Harel, G. Kimchi, G. Yaniv, N. Knoller

13:49 - 14:16
DEBATE: DENS FRACTURE IN THE ELDERLY: COLLAR OR SURGERY?
PRO COLLAR O. Keynan
PRO SURGERY Y. smorgick

14:17 - 14:22
DISCUSSION

## SESSION 3: SCOLIOSIS & TECHNOLOGY
## CHAIRMEN: Y. FLOMAN, Y. MIROVSKY

14:23 - 14:32
(3.1) CLOSTRIDIUM DIFFICILE COLITIS IN PATIENTS UNDERGOING SCOLIOSIS SURGERY
A. Jurban, Y. Smorgick, O. Rabau, Y. Mirovsky, E. Shalmon, Y. Anekstein

14:33 - 14:42
(3.2) APIFIX MID-C SYSTEM DEVELOPMENTAL HISTORY IN MANAGING MODERATE ADOLESCENT IDIOPATHIC SCOLIOSIS
M.A. Millgram, U. Arnin, E. Ashkenazi, Y. Floman

14:43 - 14:52
(3.3) ESSENTIAL LORDOSIS REVISITED
O. Hershkovich, A. D'Souza, P. R. P. Rushton, I. S. Onosi, W. W. Yoon, M. P. Grevitt

14:53 - 15:02
(3.4) FEASIBILITY STUDY OF PEDICLE SCREW PLACEMENT IN THE SPINE WITH THE XVISION SPINE SYSTEM
R. Harel, M. Raichel, Y. Smorgick, Y. Anekstein, Y. Mirovsky

15:03 - 15:12
(3.5) ZYGOFIX: A NEW INNOVATIVE (ZLOCK) SOLUTION TO LUMBAR SPINAL STENOSIS AND BACK PAIN
L. Merom, S. Vider, O. Levy, E. hadad, K. Hamud, O. Keynan

15:13 - 15:22
(3.6) THE INCIDENCE OF NEUROMONITORING EVENTS DURING ROBOTIC GUIDED SCREW INSERTION IN PEDIATRIC AND ADOLESCENT SPINAL DEFORMITY SURGERY
R. Sarhan, Y. Barzilay, H. Arzi

15:23 - 15:28
DISCUSSION

# SCIENTIFIC PROGRAM

15:29 - 15:56
DEBATE: ROBOTIC SURGERY: THE NEXT GOLD STANDARD OR AN ECONOMIC BURDEN?
GOLD STANDARD
A. Harel
UNSUSTAINABLE ECONOMIC BURDEN
A. Amitai

15:57 - 16:57
EXHIBITION BREAK

## SESSION 4: THORACO-LUMBAR
## CHAIRMEN: A. SHPIGELMAN, M. RAICHEL

16:58 - 17:07
(4.1) A PROSPECTIVE STUDY OF THE ROLE OF BLADDER SCANNING AND POST-VOID RESIDUAL VOLUME MEASUREMENT IN IMPROVING DIAGNOSTIC ACCURACY OF CAUDA EQUINA SYNDROME
G. Katzouraki, A. J. Zubairi, O. Hershkovich, M. P. Grevitt

17:08 - 17:17
(4.2) SPORT ACTIVITY AFTER THORACOLUMBAR SPINAL OPERATION - SURVEY OF SPINE SURGEONS – PRELIMINARY RESULTS
A. Keren, K. Dallasheh, Y. Mohamad, M. Raichel

17:18 - 17:27
(4.3) ASSOCIATION BETWEEN LUMBOSACRAL TRANSITIONAL VERTEBRAE AND SPINAL PATHOLOGIES BASED ON T2 WHOLE SPINE SAGITTAL MAGNETIC RESONANCE IMAGING
Y. Smorgick, O. Rabau, S. Tal, E. Tamir, M. Levshin, Y. Mirovsky, Y. Anekstein

17:28 - 17:37
(4.4) INTRA-DISCAL DRAIN INSERTION FOR CULTURE AND DRAINAGE OF PYOGENIC SPONDYLODISCITIS: A ONE-STEP DIAGNOSTIC AND THERAPEUTIC PROCEDURE
T. Ackerman, J. Singer-Jordan, A. Shani, N. Rahamimov

17:38 - 17:47
(4.5) INTRA-VENOUS STEROIDS FOR TREATMENT OF LUMBO-SACRAL RADICULOPATHY SECONDARY TO INTERVERTEBRAL DISC HERNIATION: A RETROSPECTIVE STUDY OF 229 PATIENTS
D. Kovarsky, A. Shani, A. Rod, D. Ciubotaru, N. Rahamimov

17:48 - 17:57
(4.6) DISC HERNIATION AFTER LUMBAR DECOMPRESSION - RISK FACTORS ANALYSES
E. Shalem Arazi, O. Uri, O. Besor, M. Abo Hosen, Y. Folman, E. Behrbalk

17:58 - 18:03
DISCUSSION

18:04 - 18:13
(4.7) COMPRESSIVE EPIDURAL HEMATOMAS IN PATIENTS WITH EPIDURAL CATHETERS REQUIRING FULL ANTICOAGULATION
Y. Barzilay, M. Jaber, Y. Hen, H. Arzi, J. S. Winestone, M. A. Sarhan, A. Hamad

18:14 - 18:23
(4.8) ACUTE STRESS FRACTURES OF LUMBAR PEDICLES IN AN ADOLESCENT FEMALE ATHLETE: CASE REPORT AND OUR SURGICAL VIEW
A. Shpigelman, O. Takxiro, K. Aslan

18:24 - 18:33
(4.9) COCCYGECTOMY FOR COCCYGODYNIA-LITERATURE REVIEW
S. Vider, L. Merom, E. hadad, K. Hamud, O. Keynan

18:34 - 18:43
(4.10) PEDIATRIC SPINAL CORD INJURY, EPIDEMIOLOGY AND OUTCOME
S. Alexandra, L. Kaplan, S. Sagiv, H. S. Yeshuv, J. Schroeder

# SCIENTIFIC PROGRAM

18:44 - 18:53
(4.11) AWAKE PERCUTANEOUS FIXATION FOR UNSTABLE FRACTURES OF THE SPINE IN HIGH RISK PATIENTS – A RETROSPECTIVE STUDY
E. Valero, L. Kaplan, H. S. Yeshuv, N. Bineth, J. Cohen, J. E. Schroeder

18:54 - 18:59
DISCUSSION

20:00
COCKTAIL MEAL ON THE HALON TERRACE

# MINIMALLY INVASIVE DISCECTOMY VERSUS OPEN LAMINECTOMY AND DISCECTOMY FOR THE TREATMENT OF CAUDA EQUINA SYNDROME: A CASE CONTROL STUDY.

G.J. REGEV, A. GRUNDSHTEIN, M. KHASHAN, B. KUZMENKO, D. OFIR, K. SALAME, D. NIRY, Z. LIDAR

Department of Neurosurgery, Tel-Aviv Sourasky Medical Center, Israel;
Sackler Faculty of Medicine, Tel Aviv University, Tel-Aviv, Israel.

## STUDY DESIGN

A retrospective comparative study.

## OBJECTIVES

To compare surgical complications, neurological and functional outcomes following minimally invasive discectomy (MID) and open laminectomy and discectomy for the treatment of Cauda Equina syndrome (CES).

## METHODS

The clinical and radiological presentation, surgical data and outcomes of patients who underwent surgery for CES were reviewed. Final outcomes included postoperative lower extremity motor score (LEMS), Numerical Rating Scale (NRS) for leg and back pain, Oswestry disability index (ODI), and the EQ-5D health-related quality of life questionnaire.

## RESULTS

Twelve patients underwent MID and 12 underwent open laminectomy and discectomy. No significant differences were found in the preoperative clinical presentation, neurological deficits or radiological assessment. Complications and revisions rates were also comparable between the groups. Postoperative urine incontinence and saddle dysesthesia improved in 50% of patients in both groups. LEMS scores improved from 47.08 ± 5.4 to 49.27 ± 0.9 in the MID group and from 44.46 ± 5.9 to 49.0 ± 1.4 in the open group. Although, leg pain improved in both groups 8.4 ± 2.4 to 3±2.1 in the MID and 8.44 ± 3.3 to 3.88 ± 3 in the open group, significant improvement in back pain was found only in the MID group. Final functional scores were not statistically different between the groups.

## CONCLUSIONS

Minimally invasive discectomy for the treatment of CES was found to be an effective and safe procedure when compared to open laminectomy and discectomy.

# OUR INITIAL EXPERIENCE WITH XLIF CASES – CLINICAL AND RADIOLOGICAL OUTCOME

R. MASARWA[1,2], U. OFIR[1,2], Y. STEINFELD[1,2], A. YASSIN [2], Y. FOLMAN[1,2], E. BEHRBALK[1,2]

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2. Rappaport Faculty of Medicine, Technion University.

## INTRODUCTION

Extreme lateral interbody fusion (XLIF) is a minimally invasive procedure which has been gaining acceptance over the past decade for the treatment of degenerative and adult spine deformity. In this way, the potential complications with an anterior approach to the lumbar spine (ALIF) can be avoided.

We present our first 12 XLIF cases performed at Hillel-Yaffe Medical Center.

## METHODS

We retrospectively reviewed the clinical and radiological data of first twelve patients series

following XLIF procedure at a mean follow-up of 6 months. 23 cages were inserted in 6 males and 6 females. The mean age was 69±7 years and mean BMI was 26±4 Kg/m2. In all patients XLIF was performed as a primary procedure for degenerative-disc-disease.

MFAST XLIF cage system was used in all cases

## RESULTS

A single level XLIF was performed in five patients, 2-level XLIF in three patients and 3-level XLIF in four patient.The mean pain level decrease from 8.8 to 4.6 (p=0.0029)

The mean owestry score improved by 25 (p=0.0389)

Pre-operative to post-operative radiographic changes: (1)L4-L5 Disc height of  increased from 5.65±2.24 mm to 12.45±1.34 mm, (2) Lumbar lordosis increased from 39.03±15.93° to 45.93±16.29° (p<0.0001), (3) L4-L5 Neural canal height changed from 12.76±4 mm to 18.0±5.3 mm.

The mean hospital stay was 6±1.9 days

Follow-up radiographs revealed no hardware subsidence or loosening. No patient required revision surgery.

## CONCLUSION

Our initial experience with XLIF operation is encouraging and safer.

The technique allows for excellent restoration of the sagittal vertebral parameters to their pre-degeneration status while enlarging the segment neuronal canal height without the concern of potential approach complications.

# LONG TERM PAIN CHARACTERISTICS AND MANAGEMENT FOLLOWING MINIMALLY INVASIVE SPINAL DECOMPRESSION AND OPEN LAMINECTOMY AND FUSION FOR SPINAL STENOSIS.

G.J. REGEV[1,2], G. LEOR[1,2], U. HOCHBERG[2,4], R. ANKORI[1,3], D. OFIR[1], K. SALAME[1,2], M. KHASHAN[1], R. KEDEM[3], Z. LIDAR[1,2]

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## STUDY DESIGN

A retrospective comparative study.

## OBJECTIVES

Compare the long-term pain characteristics and its chronic management following minimally invasive spinal (MIS) decompression and open laminectomy with fusion for lumbar stenosis.

## METHODS

The study cohort included patients with a minimum 5-year postoperative follow-up that underwent either MIS decompression or laminectomy with fusion for spinal claudication. The primary outcome of interest was chronic back and leg pain intensity. Secondary outcome measures included: pain frequency during the day, chronic use of non-opioid analgesics, narcotic medications, medical cannabinoids, and continuous interventional pain treatments.

## RESULTS

A total of 95 patients with lumbar spinal stenosis who underwent one or two levels surgery for lumbar spinal stenosis between April 2009 and July 2013. Of these, 50 patients underwent MIS decompression, and 45 patients open laminectomy with instrumented fusion. In the fusion group, a higher percentage of patients experienced moderate to severe back pain, 48% compared to 21.8% of patients in the MIS decompression group ($P<0.01$). In contrast, we found no significant differences in reported leg pain in both groups. In the fusion group, 20% of the patients described their back and leg pain as persistent throughout the day compared to only 2.2% in the MIS decompression group ($p<0.05$). A trend towards higher chronic dependence on analgesic medication and repetitive pain clinic treatments was found in the fusion group.

## CONCLUSIONS

MIS decompression for the treatment of degenerative spinal stenosis resulted in decreased long-term back pain and similar leg pain outcomes, compared to open lam.

# PERCUTANEOUS ENDOSCOPIC DISCECTOMY CLINICAL AND SURGICAL OUTCOMES, A SINGLE-CENTER EXPERIENCE

S. YASSIN[1], S. HARNOF[1,2], S. DAVIDOVICH[1], S. JACKSON[1], D. COGAN[1], A. HASHARONI[1] ,E. ITSHAYEK[1,2]

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2. Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

## BACKGROUND

Open lumbar discectomy and open cervical discectomy and fusion are the gold standard method for lumbar and cervical disc herniation. In selected cases cervical keyhole foraminotomy will apply. Recent progress in endoscopic spinal surgery has increased the popularity of percutaneous endoscopic lumbar discectomy (PELD) and posterior percutaneous endoscopic cervical foraminotomy(P-PECF) for this indication. PELD and P-PECF has proved to be superior to conventional open surgery methods, in terms of native anatomy preservation, minimal postoperative complications and faster recovery. However, these advancements require a longer learning curve for inexperienced surgeons. The aim of our study is to investigate the postoperative clinical improvement for PELD and P-PECF patients regarding radicular pain, complications, reoperations and learning curve analysis.

## METHODS

A retrospective analysis of 52 patients treated with percutaneous endoscopic discectomy PED between June 2019 and March 2021 for symptomatic lumbar/cervical disc herniation refractory to conservative therapy, in Rabin medical Center, done by one surgeon. Clinical outcomes were assessed using a visual analogue scale (VAS) for back and radicular pain, scored before and after surgery, operation duration, complications, length of hospital stay, time to work resumption, disc herniation recurrence.

## RESULTS

Our cohort consists of 52 cases with average age 42±16.05 years. Out of them 30 were males (57.7%) and 22 (42.4%) females. Out of 52 patients, 47(90%) underwent PLED with interlaminar approach (ILA) (74.5% discectomy L5/S1 vs. 25.5% lateral recess decompression and discectomy L4/5). Five patients from 52 had P-PECF. The mean VAS for back and radicular pain have improved from 8.44±2.06 to 1.08±1.35. The average hospital stay was 0.89±0.95 day. The mean operative time was 87.4±36.44 minutes. Symptoms improvement was reported in 48 patients (90%). The average return to work after surgery was 4.95±4.59 weeks. Surgical skin incision was 5-6 mm. regarding the intra- and perioperative complications, three patients had recurrent disc herniation within 3 months required reoperation (5.7%), conversion to open microdiscectomy was required in two patients with large disc herniation (3.8%), five patients had transient postoperative leg numbness caused by traction of working-channel (9.6%), three patients had incidental durotomy (5.7%). There was no nerve root injury, infections, epidural hematomas, vascular, or visceral injuries complication.

## CONCLUSIONS

We present our preliminary experience using PELD/ P-PECF treating lumbar and cervical degenerative disease. The presented cohort had good clinical outcome, short postoperative hospitalization and low rate of complication. However, a steep learning curve is required.

# RESECTION OF EXTRADURAL TUMORS OF THE SPINE IN PEDIATRIC POPULATION BY MINIMALLY INVASIVE TECHNIQUES

Z. LIDAR, D. OFIR, G.J. REGEV, M. KHASHAN, K. SALAME

## BACKGROUND CONTEXT

Benign tumors of the spine are generally an uncommon cause for surgery. Complete removal of these tumors commonly requires extensive surgical technique that usually consists of generous surgical exposure followed by laminectomy, facetectomy and sometimes even an instrumented fusion.

## PURPOSE

To describe our experience performing intra-lesional resection of intraosseous benign tumors from various locations of the vertebral column, utilizing a minimally invasive tubular retractor system through a variety of surgical approaches. The surgical technique, as well as the patient outcomes, are presented and discussed.

## STUDY DESIGN

Retrospective case series.

## METHODS

Records of patients who underwent minimally invasive resection of vertebral tumor were reviewed. Patients had been evaluated preoperatively and postoperatively at 1, 3, and 6 months intervals. Outcome measures included a complete neurological examination, and pain, as measured by the visual analog scale (VAS). Secondary outcomes included post-operative spinal instability, and surgical margins. These were assessed clinically and radiographically using plain radiographs and 3-month postoperative CT scans. Final pathological report, operative time, blood loss, complications, and hospital length of stay were also recorded.

## RESULTS

Between May 2009 and December 2013, 14 patients underwent minimally invasive, resection of benign bony spinal tumors at our institution. There were 8 men and 6 women with a mean age of 27 years (range 16-68 years). In the six cases with tumors located in the posterior elements- a direct posterior approached was used. Tumors located at the pedicle of the vertebra were excised using a trans-pedicular approach. In two cases where the tumor was protruding into the foramen, the trans-foraminal approach was used. The trans-canal approach was used in two cases when decompression of the thecal sac or nerve root was required, and the retroperitoneal trans-psoas approach was used in the remaining case. Satisfactory removal of the tumor was achieved in all cases, and was verified by a follow-up CT scan. Pathology revealed Osteoid Osteoma in 5 patients, Osteoblastoma in 3 patients and Eosinophilic Granuloma, Fibrous dysplasia and Fibroid adenoma in the rest. Average improvement of the Visual Analog Score was from an initial 7.7 (7-9) to 2.8 (0-7) following surgery.

## CONCLUSIONS

Our early results suggested that minimally invasive techniques are a valuable choice for the treatment of benign osseous tumors of the spine. A larger, long-term study is in progress. In the meantime, we suggest that this technique be considered by surgeons experienced both with open and minimally invasive spine surgery.

# DOES TOBACCO SMOKING AFFECT THE POST-OPERATIVE OUTCOME OF MIS LUMBAR DECOMPRESSION SURGERY?

D. OFIR, M. KHASHAN, G. REGEV, K. SALAME, L. MANGEL ,Z. LIDAR

## BACKGROUND

Minimally invasive (MIS) decompression for the treatment of spinal stenosis or disk herniation is often indicated if conservative management fails. Previous studies demonstrated a significant negative impact of smoking on spinal surgeries' outcome. However the influence of smoking on MIS spinal decompression is yet to be established. Therefore, we sought to compare clinical outcome post-operative complication following MIS decompression smoking patients and non-smoking patients.

## METHODS

We evaluated medical records of 132 consecutive patients who underwent minimally invasive lumbar decompression between November 2013 and July 2017 at our institute. The data was collected prospectively to our data base, the study (S) group included 36 smoking patients and the control (N) group comprised 96 nonsmoking patients. Medical history, American Society of Anesthesiologists ASA score, perioperative mortality, complications, and revision surgery rates were collected and analyzed. The Oswestry Disability Index (ODI) was used to evaluate functional outcome.

## RESULTS

The two groups were comparable in terms of demographic and preoperative variables. No significant difference was found in rated of post-operative complications and revision surgeries between the groups. Both groups showed significant improvement in their ODI scores at 12 and 24 months following surgery.

## CONCLUSIONS

Our results indicate in patients undergoing MIS lumbar decompression smoking may not be a significant risk factor for post-operative complications or poorer clinical outcome.

# VERTEBRAL OSTEOPOROTIC FRACTURES. A TREATMENT-BASED COMPARISON OF MORTALITY.

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Spine Unit, Carmel Medical Center, Haifa

## STUDY DESIGN

A retrospective cohort study.

## SCIENTIFIC BACKGROUND

Vertebral osteoporotic fractures are a debilitating condition associated with considerable reduction of quality of life, mortality and morbidity. Different studies showed different results regarding the increased mortality and only few studies questioned if a surgical intervention can prevent it.

## OBJECTIVE

To compare the mortality and morbidity after vertebral osteoporotic fractures in patients undergoing conservative treatment and vertebroplasty to healthy cohorts with no vertebral osteoporotic fracture

## METHODS

All patients treated for vertebral osteoporotic fractures in our institution between august 2009 and august 2016 were included. Community healthcare data of the verified cohort was extracted, matched and paired with each patient's file. The extracted data includes: sex, age, date of death and the number of chronic medications issued before (up to three months) hospitalization. The data of a random group of patients with the above parameters, albeit without a vertebral fracture, were issued to serve as a control for the study's cohort. Overall survival was evaluated using Kaplan-Meier survival plots and Log Rank was used to compare between groups.

## RESULTS

The study included 450 patients, comprising 72 patients who underwent vertebroplasty, 378 patients who underwent conservative treatment; those were compared to 3300 patients with no fracture. A statistically significant correlation was found between patients' sex, age and chronic medication usage the presence of new fracture and mortality. The presence of a new vertebral fracture hazard ratio was 1.35. Hazard ratios of 0.7 for female sex, 1.11 per year, and 1.045 for any additional chronic medication taken were found. When comparing patients who underwent conservative treatment to patients who underwent vertebroplasty a HR of 1.41 is found, however not significant (P=0.29)

## CONCLUSIONS

Vertebral osteoporotic fracture is an independent factor for increased mortality after adjustment for age, sex and general health status.

## KEY WORDS

Osteoporotic vertebral fracture, mortality.

# COST-BENEFIT ANALYSIS OF ROUTINE BONE BIOPSY DURING AUGMENTATION OF OSTEOPOROTIC VERTEBRAL COMPRESSION FRACTURES

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1. Department of Orthopedic Surgery, Wolfson Medical Center, Holon, Israel
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4. Carmel Medical Center, Haifa, Israel
5. Sheba Medical Center, Tel Hashomer, Israel

## STUDY DESIGN

Multi-center prospective study.

## OBJECTIVE

To analyze the cost of routine biopsy during augmentation of osteoporotic vertebral compression fractures (VCF) and the affect it has on further treatment.

## SUMMARY OF BACKGROUND DATA

Vertebroplasty (VP) and Balloon Kyphoplasty (BKP) are accepted treatments for VCF. Bone biopsy is routinely performed during every VCF surgery in many centers around the world to exclude an incidental finding of malignancy as the cause of the pathological VCF. The incidence been reported as 0.7% to 7.3%, however the published cohorts are small and do not discuss cost-benefit aspects.

## METHODS

From 2008 to 2016 we performed 122 vertebral biopsies routinely on 116 patients in three hospitals. Twentythree patients had history of malignancy (26 biopsies) and four were suspected of having malignancy based on imaging findings. The remaining 86 patients (99 biopsies) were presumed osteoporotic VCF.

## RESULTS

Out of 99 biopsies in the VCF cohort group only one yielded an unsuspected malignancy (1.16%), positive for multiple myeloma (MM). The ability of clinical assessment and imaging alone to diagnose malignancy was found to be 91.7% sensitive and 84.2% specific in our cohort.

## CONCLUSION

Routine bone biopsy during vertebral augmentation procedure is a safe option for evaluating the cause of the VCF but has significant cost to the health system. The cost of one diagnosed case of unsuspected malignancy was $31,000 in our study. The most common pathology was MM, which has not been proven to benefit from early diagnosis. When comparing clinical diagnosis with imaging, a previous history of malignancy was found in only 40.7% of VCF patients, while imaging was 100% accurate in predicting presence of malignancy on biopsy. This study reassures spine surgeons in their ability to diagnose malignant VCFs and does not support the significant cost of routine bone biopsies.

## KEY WORDS

biopsy, kyphoplasty, osteoporotic compression fracture, vertebroplasty.

# KYPHOPLASTY FOR ELDERLY PATIENTS WITH VERTEBRAL COMPRESSION FRACTURES - DO WE SAVE LIVES?

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## STUDY DESIGN

Retrospective cohort.

## OBJECTIVES

We aimed to compare a large cohort of patients with vertebral compression fractures (VCF) treated in 2 centers using different protocols (conservative vs BKP) and compare mortality rates on a long-term follow-up.

## METHODS

Retrospective cohort held in 2 medical centers (W and AH). All patients admitted with VCF from November 2008 to January 2015 were enrolled in the study. Exclusion criteria were patients admitted with non-osteoporotic pathological fractures (such as metastatic or MM).

## RESULTS

Our study included 208 patients treated for VCF, 127 were treated with BKP (88 females, 69.3%) and 81 were treated conservatively (59 females, 72.8%). Patients from Centre W were older and frailer compared to the patients from AH center (Average age 75.12 + 11.16 vs 69.13 + 9.61 years and Frailty score of 0.16 + 0.1 vs 0.12 + 0.1 respectively, T-test, $p < 0.01$ for both). Hazard ratios (HR) for age, female gender and frailty were significant for increased mortality, frailty had the highest HR of 182.42 (CI 29.05-1145.33, $p < 0.01$). Multivariate Cox model was fitted and after accounting for Gender, Age and Frailty, no significant difference was found between the 2 medical centers mortality rates (p ¼ 0.59), thus no difference in mortality rates between BKP and conservative treatment in our study.

## CONCLUSION

long-term follow-up following BKP treatment for VCF did not show a reduced mortality rate compared to conservative treatment after accounting for frailty, age and gender. Frailty was the most important factor in predicting mortality.

Further RCTs are needed to compare the quality of life differences between the 2 treatment strategies.

## KEYWORDS

osteoporotic fractures, vertebral compression fractures, mortality.

# THE TREATMENT OF PAINFUL VERTEBRAL FRACTURES UNDER LOCAL ANESTHESIA

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## INTRODUCTION

Painful compression and pathological fractures of vertebras are amongst the most common fractures in the human skeleton. They cause significant pain and limitation of motion in a sick or elderly population. The common initial care is pain control and at times bracing in a attempt to control the painful symptoms and allow mobility. However, in cases that this treatment fails- cementation of the vertebrae (kyphoplasty/ vertebroplasty) is the next step. In many of the producers anesthesia is dangerous and can limit the ability to assist these patients. We here present the outcome of patients treated for painful fractures treated with local anesthesia with mild sedation.

## METHODS

All patients with painful compression fracturs treated by cementation under local anesthesia were collected between the years 2018-2019. The procedure was performed in the intervention radiologist operating room, with a senior interventionist and a spine surgeon working together in order to reduce procedure time and radiation exposure. Indication for the procedure, levels of broken vertebrae, procedure duration, pain control before and after procedure were assessed, length of hospital stay and complications were assessed.

## RESULTS

170 patients were treated with vertebral fractures, of them 163 had complete data and were included in the study. Fracture levels were from T3 to Sacrum. Patients had one to four fractures. In all patients the pedicle was cannulated with cement injected to fracture. Procedure time ranged from 25 to 8 minutes (mean 12 min) depending on pedicle size and orientation.  47% had pathological fractures and 53% had osteoporotic fractures. Average age was 71.2. There were no neurological complications, in three cases there was leakage into the spinal canal but without clinical significance. VAS pain score prior to surgery was 9.5 (range 8-10) and dropped to 1.9 (range 6-0) at last follow-up.

## CONCLUSION

Kyphoplasty under local anesthesia is a quick, safe and efficient procedure, in most cases it can be done in an ambulatory setting.

# EPIDEMIOLOGY OF OPLL IN THE JEWISH POPULATION IN ISRAEL: A RADIOGRAPHIC AND CLINICAL ANALYSIS

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## OBJECT

The prevalence of Cervical Ossified Posterior Longitudinal Ligament (C-OPLL) varies between populations and geographic regions. To date, its prevalence rate in the Jewish population has not been determined. The aim of this study is to evaluate the prevalence and characteristics of C-OPLL in the Jewish population.

## METHODS

A retrospective evaluation of imaging studies of all adult patients who underwent both cervical CT and MRI for all clinical indications within a span of 36 months between January 2017 and July 2020 in a Sheba Medical Center was performed. Identified C-OPLL carriers were contacted by telephone and questioned for current symptomatology and demographics including religion, Jewish ethnic identity, birthplace, parental birthplace and ethnic identity, and family history of spinal disorders.

## RESULTS

Overall, 440 subjects were radiographically evaluated. The prevalence of C-OPLL in the Jewish population was 7.5% (33 out of 440), with a mean age of 65.8 years. All patients were symptomatic during the time of analysis. Among carriers, there was an increased proportion of Sephardic Jewish ethnic identity (65.4%), with a significantly high rate of homogenous parental Jewish identity (92.4%), suggesting a prominent genetic contribution to the development of this condition.

## CONCLUSION

The prevalence of C-OPLL in the Jewish population in central Israel was 7.5%. This rate is significantly higher compared to other previously studied populations. To our knowledge, this is the first publication to identify the Jewish population as suffering from an increased prevalence of C-OPLL.

# MULTI CERVICAL REHABILITATION UNIT IMPROVES RANGE OF MOTION AND CERVICAL SPINE MUSCLE STRENGTH IN AVIATORS WITH CERVICALGIA – A RETROSPECTIVE ANALYSIS

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## BACKGROUND

Cervicalgia affects 29-89% of air force pilots. High G forces, unfavorable neck positions, and the use of heavy helmets predispose military aviators to cervical spine injuries. These injuries may lead to temporal and/or permanent disqualification from fighting duties. Physical therapy and other nonoperative interventions have not proved to be effective. The Multi Cervical Unit (MCU) device is used for measurement of cervical active range of motion (AROM) and maximal isometric muscle strength (MIMS) and to strengthen cervical spine and to improve cervical spine AROM. The purpose of this retrospective analysis was to determine the effect of MCU treatment series on cervical functionality in aircrew members with chronic cervicalgia unresponsive to physical therapy and pain medications.

## METHODS

In this IRB approved retrospective analysis, data of aviators that completed at least 6

MCU treatment sessions during the years 2008–2017 was collected. The study outcomes were changes in AROM [deg] and MIMS [kg] from first to last treatment session in all movement directions (flexion/extension, lateral rotation, lateral flexion). Change was tested with paired t-test. Before and after measurements were separately compared to values of the normal population (literature-based) using 1-sample t-test with Bonferroni's correction for multiple comparisons. Baseline dependence was determined by linear regression and baseline measurements were automatically classified by the Cleveland method into quartiles of %improvement.

## RESULTS

Thirty-three (n=33) male IDF pilots and navigators (mean±SD: age 34.3±5.9; BMI 23.7 ± 2.6) with cervicalgia, unresponsive to physical therapy, were included in this analysis. Compared to the normal population, baseline AROM was significantly limited (9-25%), while baseline MIMS was significantly stronger (17-34%). MCU treatments resulted in a highly significant improvement ($p<0.001$) in all 6 AROM and 4 MIMS directions (18-23% and 72-94%, respectively), achieving normal AROM (except in extension) and even stronger MIMS compared to the normal population. Significant moderate to strong baseline dependence was determined in 5/6 AROM directions but not in MIMS. By the quartile methods, patient baseline characteristics that were predicted to achieve >20% improvement in ROM and >80% improvement in MIMS was determined.

## CONCLUSIONS

MCU treatments significantly improved cervical spine functional measures in aviators with chronic cervicalgia. Using AROM and MIMS measurements, before and at the completion of MCU treatment series, we characterized baseline data that is predicted to achieve the best gain in cervical functionality from this therapeutic modality. Future prospective studies should combine AROM and MIMS data with clinical outcomes.

# INTEGRITY OF THE TECTORIAL MEMBRANE IS A FAVORABLE PROGNOSTIC FACTOR IN ATLANTO-OCCIPITAL DISLOCATION

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## BACKGROUND

Atlanto-occipital dislocation (AOD) is considered to be a frequently fatal injury with a substantial risk for severe neurological deficits. To date, numerous publications have centered on identifying prognostic factors in this population. Mostly, they are based on clinical indicators at presentation and radiographic parameters. The aim of this study is to illustrate a novel prognostic factor in atlanto-occipital dislocation, based on cervical MRI studies in a small case series of patients who suffered this injury.

## METHODS

Over the course of the past year, the authors have treated three consecutive patients with atlanto-occipital dislocation who attained an excellent clinical outcome. The authors have retrospectively evaluated clinical, surgical and radiographic parameters in search of a common denominator to explain the excellent outcome of these patients.

## RESULTS

All patients presented with severe polytrauma that required urgent surgical intervention. The patients were subsequently treated with an occipitocervical fusion. The cervical MRI studies of all patients were notable for a having a preserved tectorial membrane, while other primary stabilizers of the craniocervical junction such as the apical, alar and cruciate ligaments were shown to be severely disrupted. We consider this anatomical distinction to account for their benign clinical course.

## CONCLUSION

A preserved tectorial membrane appears to be an important favorable prognostic factor in atlanto-occipital dislocation and may serve to mitigate neurological outcome in such injuries.

# CENTRAL CORD SYNDROME IN A YOUNG MALE NOVICE SURFERS

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## BACKGROUND

Central cord syndrome (CCS) is an injury seen usually in old patients with spinal stenosis, causing tetraplegia characterized by a greater involvement of the upper limbs.

Most surfing injuries are lacerations, sprains, and fractures. Among neurological surfing injuries, surfer's myelopathy, a non-traumatic paraparesis, is the most common entity. Commonly in young, healthy, novice surfers with no pre-existent spinal disease.

CCS is usually not suspected as a surfing injury, especially when the patient is young and previously healthy. It was not previously reported in the literature as a surfing injury until our recent case report, published June 2018. We described A 35-year-old male novice surfer presented to the emergency department with acute tetraplegia and sensory deficit, following falling off his surfboard. Radiological investigations showed advanced spinal stenosis and myelopathy. He was diagnosed as having CCS, treated conservatively, and made near full recovery.

Since then, we diagnosed four more similar cases. All were young, healthy male surfers, that fell off their surfboard. All suffered from CCS with different levels of severity.

## METHODS

We report a total of 5 cases of CCS following surfing accidents, diagnosed between 2017-2021. We compared their ASIA scores in their presentation to the ER and during their follow ups.

## RESULTS

Mean age was 39 years. We found no statistical differences between patients AIS or ISNCSCI scores. All five cases had sensory deficits at some degree, only one patient completely recovered. Four out of five cases had a motor deficit at presentation, three out of the four completely recovered from their motor symptoms. Four out of five cases had vertebral fractures without dislocations and without bony cord compression or canal protrusion. None of the patients underwent a surgical procedure.

## CONCLUSIONS

Surfing injuries resulting in CCS may be a more common phenomenon then we know, affecting not only older adults with degenerative spinal stenosis, but also younger more active adults. In this younger population, symptoms normally resolve spontaneously without sequelae or the need for surgical intervention.

CCS in young healthy patients might be strongly associated with simple vertebral fractures, as seen in four out of five of our patients.

# SPINAL AVF: SURGICAL CONSIDERATION WHEN ANGIOGRAPHY IS MISLEADING.

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## INTRODUCTION

Spinal AVF cause a progressive myelopathy and is often a diagnostic challenge. In recent years, most AVFs are treated by endovascular embolization and surgery is performed if endovascular closure failed. Surgical closure is targeted by angiography for fistula level and side. In this presentation we will describe three recently operated cases in which angiography did not match the clinical findings. We will propose a management algorithm for those cases.

## METHODS

We retrospectively reviewed AVF cases and describe our experience for the angiography mismatch cases.

## RESULTS

Four cases of spinal AVF will be presented. Two patients' angiography demonstrated a wrong level fistula and the third demonstrated no fistula. All had undergone spinal exploration and fistula closure.

## CONCLUSIONS

Spinal angiography is the primary guidance for AVF closure, but surgeons might encounter misleading angiography, necessitating exploration surgery for AVF closure.

# CLOSTRIDIUM DIFFICILE COLITIS IN PATIENTS UNDERGOING SCOLIOSIS SURGERY

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## STUDY DESIGN

Retrospective database analysis.

## OBJECTIVE

To investigate incidence and comorbidities of patients with Clostridium difficile infection after surgery for adolescent idiopathic scoliosis.

Summary of Background Data. Clostridium difficile colitis is reportedly increasing in hospitalized patients and can have a negative impact on patient outcomes. No data exist on estimates of C. difficile infection rates and its consequences on patient among patients undergoing surgery for adolescent idiopathic scoliosis.

## METHODS

A retrospective database review of patients younger than 18 years who underwent elective idiopathic scoliosis surgery between 2018 and 2020 was conducted. The population was divided into patients who developed Clostridium difficile colitis and those who did not. All risk factors and outcomes were analyzed using multivariate regression.

## RESULTS

A total of 100 patients were included in the study. The incidence of Clostridium difficile infection in patients undergoing surgery for idiopathic scoliosis was 3%. We did not find notable medical risk factors for the development of Clostridium difficile infection. Clostridium difficile infection was associated with a 3 day increase in length of stay.

## CONCLUSION

Following idiopathic scoliosis surgery, Clostridium difficile infection was diagnosed in 3% of patients. Clostridium difficile infection increased the risk for longer hospitalization. Future studies will focus on postoperative prophylactic antibiotics and the development of Clostridium difficile infection.

# APIFIX MID-C SYSTEM DEVELOPMENTAL HISTORY IN MANAGING MODERATE ADOLESCENT IDIOPATHIC SCOLIOSIS

M.A. MILLGRAM, U. ARNIN, E. ASHKENAZI, Y. FLOMAN

## BACKGROUND

The standard of care for treating adolescent idiopathic scoliosis (AIS) involves a steep leap from non-operative care to complex spinal surgery.

The MID-C implant by ApiFix presents an intermediate option for treating moderate AIS. Its design includes polyaxial interfaces with the anchoring pedicle screws reducing moments on the screw/bone interface. The device is attached to the spine with two anchor points. A ratchet mechanism allows elongation intra and post operatively. Continued spinal motion in the instrumented segment is facilitated. Indications for the procedure are 40°-60° Lenke curves 1 & 5 bending out to ≤30° with a kyphosis of ≤55°.

The MID-C treatment evolution encompassed 3 stages:

In the first evolutionary stage of 50 patients only 3-4 segments were bridged and intraoperative correction was moderate.

In the second stage numbering 155 patients, longer implants were employed spanning 5-6 segments and curve flexibility was paramount in patient selection.

In the third and current stage numbering 290 patients as of April 28, 2021 implant proximal anchorage is augmented with an extender connecting polyaxially to two pedicle screws.

We present the evolution of the ApiFix MID-C implant and surgical technique over the last 8 years.

## METHODS

Case review of 495 operated AIS patients

## RESULTS

During the first evolutionary stage 50 patients were treated with an average of 3.9 segments bridged. The average pre-operative Cobb angle was 44° reduced to 36° degrees at last follow up. Numerous learning curve complications were encountered.

During the second evolutionary stage 155 patients were treated with an average of 5.1 segments bridged. Pre-operative curve magnitude was 46° with an average lateral bending of 21°. At last follow up the Cobb angle was 29°.

In the current stage with an extender (N=290) an average of 6 segments were bridged and the average pre-operative curve was 46° bending out to 19° with the final angle being 25°.

With the correction of the primary curve a spontaneous correction of the secondary curve was noted. There were +/- 5° changes in the sagittal contour without clinical significance.

Complications in the 3rd phase:

Screw pullout 0.9%, screw malplacement & migration1.7%, infection 2.4% (the majority using a minimally invasive approach), device malfunction 0.9% and extender malalignment 1.7%.

Out of the 495 patients treated 4.3% were converted to fusion with only 1.4% in stage 3.

## CONCLUSION

The evolution of the MID-C system over the last 8 years has resulted in improved curve correction. Rigorous adherence to surgical technique and patient selection is mandatory for satisfactory outcomes.

# ESSENTIAL LORDOSIS REVISITED

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## AIMS

Significant correction of an adolescent idiopathic scoliosis in the coronal plane through a posterior approach is associated with hypokyphosis. Factors such as the magnitude of the preoperative coronal curve, the use of hooks, number of levels fused, preoperative kyphosis, screw density, and rod type have all been implicated. Maintaining the normal thoracic kyphosis is important as hypokyphosis is associated with proximal junctional failure (PJF) and early onset degeneration of the spine. The aim of this study was to determine if coronal correction per se was the most relevant factor in generating hypokyphosis.

## METHODS

A total of 95 patients (87% female) with a median age of 14 years were included in our study. Pre- and postoperative radiographs were measured and the operative data including upper instrumented vertebra (UIV), lower instrumented vertebra (LIV), metal density, and thoracic flexibility noted. Further analysis of the post-surgical coronal outcome (group 1 < 60% correction and group 2 ≥ 60%) were studied for their association with the postoperative kyphosis in the sagittal plane using univariate and multivariate logistic regression.

## RESULTS

Of the 95 patients, 71.6% (68) had a thoracic correction of > 60%. Most (97.8%) had metal density < 80%, while thoracic flexibility > 50% was found in 30.5% (29). Preoperative hypokyphosis (< 20°) was present in 25.3%. A postoperative thoracic hypokyphosis was four times more likely to occur in patients with thoracic correction ≥ 60% (odds ratio (OR) 4.08; p = 0.005), after adjusting for confounding variables. This association was not affected by metal density, thoracic flexibility, LIV, UIV, age, or sex.

## CONCLUSION

Our study supports the 'essential lordosis' hypothesis of Roaf and Dickson, i.e. with a greater ability to translate the apical vertebra towards the midline, there is a commensurate lengthening of the anterior column due to the vertebral wedging. Cite this article: Bone Joint J 2020;102-B(4):513-518.

## KEYWORDS

Adolescent idiopathic scoliosis; Essential lordosis; Hypokyphosis; Posterior surgery.

# FEASIBILITY STUDY OF PEDICLE SCREW PLACEMENT IN THE SPINE WITH THE XVISION SPINE SYSTEM

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## PURPOSE

To evaluate the safety and performance of the Xvision Spine System during spine fusion procedures involving pedicle screw placement during an open procedure.

## METHODS

The study population included 19 subjects between 18-80 years old, enrolled in three different sites in Israel. Subjects were scheduled for elective open spinal surgery that requires posterior pedicle screw placement in the sacral/ lumbar vertebrae.

System performance was evaluated by calculating the percent of accurately placed pedicle screws. Pedicle screw accurate placement was evaluated using Gertzbein score. The grade is interpreted as a system's ability to guide insertion of a pedicle implant with less than 2mm of pedicle wall breach, independent of breach direction.

## RESULTS

Eighty-six (86) screws were positioned in the sacral-lumbar vertebrae of 17 subjects. The total number of accurate scores (A or B) and inaccurate scores (C or D) per each subject were assessed on post op scans by two (2) independent US experienced neuroradiologists, using the Gertzbein score. 84 screws were graded as A or B score and 2 screws were graded as C score (2m-4mm breach). Hence, clinical accuracy was calculated to be 97.7% (84/86).

## CONCLUSION

The performance of the Xvision Spine System in accurate placement of pedicle screws in the sacro-lumbar vertebrae of 17 subjects was demonstrated with an overall accuracy of 97.7%. These results were found to be non-inferior to the reported accuracy results of other computer assisted navigation systems in the literature, and comparable to previously reported results of the XVS system when used on cadavers.

# ZYGOFIX: A NEW INNOVATIVE (ZLOCK) SOLUTION TO LUMBAR SPINAL STENOSIS AND BACK PAIN

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## BACKGROUND

In 2006, Goel et al proposed an alternative method of treatment for spinal degeneration, which involved distraction of the facets and forced introduction of "Goel Facet Spacers". The authors showed that the process of facetal distraction resulted in a remarkable reversal of almost the entire gamut of changes in the degeneration of the spine. The increase in the height of the facets resulted in an increase in the spinal canal dimensions and in the height and diameter of the intervertebral foramina.

## PURPOSE

To overcome some of the drawbacks that were presented above, ZygoFix has developed the zLOCK Facet stabilization device. The zLOCK device is intended for stabilization of a spinal motion segment, to distract the joint to perform indirect decompression, and enable percutaneous insertion approach.

Unlike the inter-facetal systems used by Goel and Grasso that are completely rigid, with no ability to fit the curved shape of the facet joint, the zLOCK device is designed so it can easily adopt the anatomy of the joint while being pushed into it.

## PATIENT SAMPLE

10 patients (5 men, 5 women, mean age 62) from 4-18 until 4-21, all suffered from lumbar stenosis and facet arthropathy, underwent Zygofix fusion along with foraminal/central stenosis of the lumbar spine.

## METHODS

Surgery was performed in the prone position, midline or MIS approach under general anesthesia.

XR- guided entry point to the facet joint, serial preparation of the facet joint, cage insertion.

## RESULTS

Primary outcome measures were ODI, and VAS scores for back and leg pain, and were reduced significantly in all patients.

## CONCLUSION

Utilizing standard or MIS approach, Zygofix seems to offer a valuable new tool with significant advantages over the traditional lumbar spinal decompression and fusion.

# THE INCIDENCE OF NEUROMONITORING EVENTS DURING ROBOTIC GUIDED SCREW INSERTION IN PEDIATRIC AND ADOLESCENT SPINAL DEFORMITY SURGERY

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## BACKGROUND

Neurologic injury is a devastating complication in spinal deformity surgery, that can range from simple neuropraxia to catastrophic spinal cord injury. The rate of neurologic injury ranges from 0.3 % to 4 % ( depending on approach, type of instrumentation, and type of neurologic injury ). The rate of spinal cord injury and nerve root injury is 0.43 % and 0.31 % respectively. Neuromonitoring is a standard of care in deformity surgery, aimed at early detection of nerve damage and allowing correction of mistakes before permanent damage has occurred. The objective of this study was to document the rate of intraoperative neuromonitoring events during robot guided pedicle screw insertion in pediatric and adolescent deformity surgery.

## METHODS

Retrospective analysis of prospective data. Adolescent and pediatric spinal deformity surgeries were screened from the registry of Sharee Zedek medical center. We included all the cases of robotic guided deformity surgery in pediatrics and adolescents between the years 2015 - 2019. We reviewed 61 cases, 1532 pedicle screws insertions were robotically guided. Data from the neuromonitoring provider at our medical center were collected and any case with neuromonitoring events was recorded.

## RESULTS

A total of 61 cases ( robotic guided deformity correction ) were included for analysis. 15 males and 46 females. 1532 screws were inserted in a robotic guided fashion. 86 screws were inserted in a free hand technique. Zero neuromonitoring event was recorded in all the robotically guided pedicle screw insertions. 4 neuromonitoring events were recorded in the free hand technique inserted screws, none of them were associated with neurologic injury.

## CONCLUSION

Our results suggest that robot guided pedicle screw insertion significantly and dramatically reduces the intraoperative neuromonitoring events, thus we highly recommend this technique as an extremely reliable and safe technique that can significantly reduce the postoperative neurologic deficits.

# A PROSPECTIVE STUDY OF THE ROLE OF BLADDER SCANNING AND POST-VOID RESIDUAL VOLUME MEASUREMENT IN IMPROVING DIAGNOSTIC ACCURACY OF CAUDA EQUINA SYNDROME

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## AIMS

Diagnosis of cauda equina syndrome (CES) remains difficult; clinical assessment has low accuracy in reliably predicting MRI compression of the cauda equina (CE). This prospective study tests the usefulness of ultrasound bladder scans as an adjunct for diagnosing CES.

## METHODS

A total of 260 patients with suspected CES were referred to a tertiary spinal unit over a 16-month period. All were assessed by Board-eligible spinal surgeons and had transabdominal ultrasound bladder scans for pre- and post-voiding residual (PVR) volume measurements before lumbosacral MRI.

## RESULTS

The study confirms the low predictive value of 'red flag' symptoms and signs. Of note 'bilateral sciatica' had a sensitivity of 32.4%, and a positive predictive value (PPV) of only 17.2%, and negative predictive value (NPV) 88.3%. Use of a PVR volume of ≥ 200 ml was a demonstrably more accurate test for predicting cauda equina compression on subsequent MRI ($p < 0.001$). The PVR sensitivity was 94.1%, specificity 66.8%, PPV 29.9% and NPV 98.7%. The PVR allowed risk-stratification with 13% patients deemed 'low-risk' of CES. They had non-urgent MRI scans. None of the latter scans showed any cauda equina compression ($p < 0.006$) or individuals developed subsequent CES in the intervening period. There were considerable cost-savings associated with the above strategy.

## CONCLUSION

This is the largest reported prospective evaluation of suspected CES. Use of the PVR volume ≥ 200 ml was considerably more accurate in predicting CES. It is a useful adjunct to conventional clinical assessment and allows risk-stratification in managing suspected CES. If adopted widely it is less likely incomplete CES would be missed. Cite this article: Bone Joint J 2020;102-B(6):677-682.

## KEYWORDS

Bladder scan; Cauda equina syndrome; Diagnosis; MRI; Post-void residual volume.

# SPORT ACTIVITY AFTER THORACOLUMBAR SPINAL OPERATION - SURVEY OF SPINE SURGEONS - PRELIMINARY RESULTS

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## INTRODUCTION

Thoracolumbar spine operations are among the most common surgical procedures, their main goal is to improve quality of life, and to help patients return to their routine hobbies and sport activities.

There is a shortage of data and concrete recommendations regarding specific sports, and the timing for return to sports activity post operatively. Guidelines for sport participation after spinal surgeries are still a matter of debate in the current literature.

## METHODS

This study was based on a design internet survey, completed by 34 spine surgeons members of the Israeli spine society, in attempt to formulate specialists opinion regarding recommendations for post-operative sports involvement.

The survey included questions regarding lumbar discectomy, thoracolumbar decompression and thoracolumbar fusion. The participants were asked about recommendations for the timing of return to sports activity in specific sport fields.

## RESULTS

About 60% of surgeons recommended regaining full sports activity after Lumbar discectomy 1-3 months post operation, 37% after Lumbar decompression and less than 10% after thoracolumbar fusion in this timeline.

Restrictions for post operational activity were divided almost equally between the three types of operations. Approximately 50% of all surgeons restrict their patients in Weight lifting High impact sports jumping and full contact sports regardless of the operation they had.

90% of surgeons recommended engaging in Hiking after 3 types of operation

85-95% of surgeons allowed swimming after discectomy/decompression, but only 70% allowed swimming after fusion.

Pilates and Yoga were allowed by approximately 70% of surgeons after any operation

Horseback riding was divided almost homogenously between allowed / allowed with experience/ not allowed after any operation

## CONCLUSIONS

1-3 months postoperatively was the period of time that most surgeons recommended to return to sports.

Most surgeons consider lumbar decompression operation require more restriction than lumbar discectomy. Fusion operations are considered to be operations that require the most restrictions regarding returning to sports post operation.

Engaging in low impact sports is recommended and sports which are considered high impact are not recommended, but there is no unity regarding which sport are considered high or low impact and no clear definition in the literature.

# ASSOCIATION BETWEEN LUMBOSACRAL TRANSITIONAL VERTEBRAE AND SPINAL PATHOLOGIES BASED ON T2 WHOLE SPINE SAGITTAL MAGNETIC RESONANCE IMAGING

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## PURPOSE

To assess the association between 4, 5, or 6 lumbar spine vertebrae and the presence of lumbar spinal pathologies.

## METHODS

We reviewed all MRI reports and images performed between August 1st, 2018 and July 31st, 2019. Lumbar spine pathologies such as disc herniation, lytic spondylolisthesis and spinal stenosis were recorded. The reviewer studied the T2 sagittal screening of the entire spine and counted down manually from C2 to T12 on the assumption that there are seven cervical and twelve dorsal vertebrae. We then recorded whether there were four, five, or six lumbar vertebrae.

## RESULTS

Our work incorporated a total of 1985 patients for whom T2-weighted entire spine sagittal MR images were obtainable. The study cohort's average age was 52.2 + 15.9 years, comprising 944 males and 1041 females. One hundred and thirty-three patients (6.7%) had 4 lumbar-type vertebrae; 1799 (90.6%) had 5 lumbar-type vertebrae; and 53 (2.7%) had 6 lumbar-type vertebrae. There was a statistically significant difference between the rate of 6 lumbar-type vertebrae in males versus females ($p<0.05$). There was a statistically significant difference with more spinal stenosis patients in the 6 lumbar-type vertebrae compared to the 4 or 5 lumbar-type vertebrae groups. ($p<0.001$)

## CONCLUSION

Our study shows that spinal stenosis is significantly more common in patients with 6 lumbar-type vertebrae.

# INTRA-DISCAL DRAIN INSERTION FOR CULTURE AND DRAINAGE OF PYOGENIC SPONDYLODISCITIS: A ONE-STEP DIAGNOSTIC AND THERAPEUTIC PROCEDURE

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## BACKGROUND

Pyogenic spondylodiscitis is diagnosed in recent years at higher rates due to the aging population, increased survival of chronic and immune suppressed patients, and the higher rate of invasive procedures leading to bacterial seeding or direct contamination of the disc space. Treatment guidelines encourage bacterial sampling before initiation of antibiotic therapy, and drainage of pus collections. We present our experience with percutaneous CT-guided drain insertion into the disc space itself as a one-step procedure for both culturing and subsequent continuous drainage of the infected disc space.

## MATERIALS AND METHODS

We retrospectively reviewed all cases of pyogenic spondylodiscitis admitted to our spine surgery unit during the past five years and treated with CT-guided percutaneous drain insertion into the infected disc space. All patients were followed until complete resolution of the infection.

## RESULTS

We retrieved electronic records of 12 patients, none presenting with neurological compression symptoms. Cultures taken at the time of drain insertion were positive in 10 patients (83.3%), much higher than the reported yield for needle aspiration (14–48%) and comparable to the yield of open biopsy. In all patients complete resolution of the infection was reached, determined by clinical, laboratory, and imaging parameters.

## CONCLUSIONS

Our retrospective case series demonstrates the feasibility and effectiveness of intra-discal CT-guided drainage of an infected disc space. The procedure does not add much burden to current practice as disc-space sampling for culture is commonly performed anyway, and adds the benefit of direct drainage of the pus at its source.

# INTRA-VENOUS STEROIDS FOR TREATMENT OF LUMBO-SACRAL RADICULOPATHY SECONDARY TO INTERVERTEBRAL DISC HERNIATION: A RETROSPECTIVE STUDY OF 229 PATIENTS

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## BACKGROUND

The natural history of lumbar disc herniation with radiculopathy is favorable, with 95% of patients expected to be pain-free within 6 months of onset. Despite the favorable prognosis under conservative care, operative treatment is often chosen by patients unable to "ride out" the radicular episode. Prospective studies, comparing surgical with non-surgical treatment, have demonstrated a high cross-over rate with 30-45% of patients undergoing surgery regardless of their initial treatment plan. Steroids in various forms of administration are commonly utilized in the treatment of lumbar disc herniation with radiculopathy although supporting evidence is limited.

## MATERIALS AND METHODS

We conducted a retrospective case-series study, with historical literature control, of patients treated with IV dexamethasone (Dexacort XXX) for symptomatic disc herniation. Included were all patients admitted to our department between August 2014 to March 2018 for intractable radicular pain without severe neurological deficits, after failing conservative ambulatory treatment. All patients had a lumbar disc herniation demonstrated on current imaging studies that corresponded anatomically with the clinical complaints and findings. Excluded were patients presenting or developing acute cauda equina syndrome or patients unable to complete steroid treatment for medical reasons.

The primary outcome measure was whether the patient had undergone operative treatment within one year of receiving the IV steroid treatment, as determined from the electronic health records (EHR) and a phone survey.

## RESULTS

229 patients meeting the inclusion criteria were found, and 118 were available for telephone survey, 34 of which (28.8) had undergone operative treatment for their disc herniation within one year of receiving IV steroid treatment.

## CONCLUSIONS

IV steroid treatment was better than the reported crossover rate in randomized controlled trials previously published. Our results do not clarify if this is due to a direct pharmacological effect on the affected nerve root or the support offered by hospitalization, helping pass the pain peak in what is essentially a time-dependent recovery.

# DISC HERNIATION AFTER LUMBAR DECOMPRESSION - RISK FACTORS ANALYSES

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## BACKGROUND

Lumbar decompression has proven to be effective surgery to treat neurological claudication due to spinal stenosis. The development of new radicular symptoms in the late postoperative period in patients who underwent posterior lumbar decompression without discectomy or fusion, for symptomatic lumbar spinal stenosis (LSS), is rare. The purpose of this study is to analyses the risk factors of postoperative lumbar disc herniation at the operated level, a less familiar complication of a minimal invasive lumbar decompression surgery (MILDS) without fusion.

## METHODS

We retrospectively reviewed medical records of 15 patients who demonstrated new radicular symptoms in the late postoperative period following MILDS without fusion for the treatment of symptomatic LSS. To examine possible risk factors of a new disc herniation after MILDS, a matched control group of 49 patients was constructed, with respects to the sex and age of the patients, in order to eliminate these factors as confounders. All patients were operated by the senior author between 2015 and 2019 and were followed-up for at least 10 months. The causes for symptoms recurrence and subsequent intervention were documented.

## RESULTS

Recurrence of symptoms and a new disc herniation diagnosis occurred at a mean of 12 months postoperatively (range, 2-23 months). The mean patient age was 61 years (range, 48-77 years). A follow-up lumbar MRI scan was obtained in all cases and compared to the preoperative MRI scan. A new disc herniation at the operated level was diagnoses in all cases and was found in correlation with the clinical presentation. Of these 15 patients, 4 underwent further surgery in which the herniated disc was removed with an improvement of their symptoms at the final follow-up.

## CONCLUSION

Lumbar disc herniation at the operated level is a less familiar complication of MILDS without fusion, performed for symptomatic LSS. Increase load on the anterior spine column following posterior decompression without fusion may be responsible for this finding. Based on this hypothesis, we examined a number of risk factors that did not yield statistical significance. As the specific risk factors for this condition have not yet been identified, further studies need to be performed.

# COMPRESSIVE EPIDURAL HEMATOMAS IN PATIENTS WITH EPIDURAL CATHETERS REQUIRING FULL ANTICOAGULATION

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## BACKGROUND

Epidural analgesia is extensively used for perioperative pain control. Compressive Spinal epidural hematoma is a rare and potentially catastrophic complication of epidural catheters. The use of regional analgesia in fully anticoagulated patients or in those requiring full anticoagulation intraoperatively is controversial, but no clear guideline exist. Thousands of regional analgesia procedures are performed in our institution annually, and in a small part, intraoperative anticoagulation is required. The purpose of this study is to present three cases of compressive epidural hematomas in patients with epidural catheters who were fully coagulated intraoperatively, who required urgent surgical intervention and to propose a protocol to reduce the risk of complete paraplegia.

## PATIENTS AND METHODS

Between January 2019 and January 2020, three patients (2 males and 1 female) with thoracic epidural catheters, who required intraoperative anticoagulation, developed acute compressive epidural hematomas with neurological manifestation, requiring urgent decompressive laminectomies. A 77-year-old male developed acute progressive paraparesis on the second post operative day, following a prolonged and complex endovascular procedure performed under full anticoagulation. A 73-year-old male underwent Whipple surgery with an unexpected vascular involvement nessesitating a vascular graft and full anticoagulation, folloed by prolonged anethesia in the ICU. He was found on post operative day 5 with complete paraplegia. A 77-year-old female underwent urgent thrombectomy from the femoral artery under full anticoagulation and developed complete paraplegia on POD 1. The two awake ptients complained of severe low back pain before the nerve damage appeared. All patients underwent urgent surgical decompression and evacuations of hematoma.

## RESULTS

The two patients presenting with complete paraplegia ended with complete cord injury. The one patient who presented with incomplete cord injury ended with mild thoracic myelopathy.

## CONCLUSION

All patients were anticoagulated according to ASA recommendations, and yet developed compressive epsidural hematome causing significant nerve damage. Severe low back pain in fully anticoagulated patiens with epidural catheters should result in urgent MRI scans and urgent surgical evacuation of the hematoma. The management of long term anesthetized fully anticagulated patients with epidural catheters remains controverstial, and if long anesthesia is expected, epidural catheters sould probably be avoided. Institutional protocols may minimize the risk of complete paraplegia.

# ACUTE STRESS FRACTURES OF LUMBAR PEDICLES IN AN ADOLESCENT FEMALE ATHLETE: CASE REPORT AND OUR SURGICAL VIEW

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## BACKGROUND

Stress fracture in the pars interarticularis is a common cause of low back pain in young athletes.

Pedicle stress fractures have also been reported in adolescent sport players, and most of them were associated with contralateral spondylolysis.

Only a few cases with bilateral pedicle stress fractures have been reported.

## METHODS

We report a 14-year-old Rhythmic Gymnastics athlete with acute bilateral pedicle stress fractures treated surgically, together with our vision of the surgical solution.

The athlete presented with low back pain limiting sports and daily activities. Radiographic evaluations revealed bilateral pedicle stress fractures of the L4 vertebra.

Fracture fixation by pedicle screws was done.

## RESULTS

The patient achieved pain relief, good fracture healing, and complete return to normal function and Rhythmic Gymnastics training.

## CONCLUSION

In this uncommon case of bilateral stress fractures of the pedicle, transpedicular screws fixation assures good healing and early return to normal function.

# COCCYGECTOMY FOR COCCYGODYNIA-LITERATURE REVIEW

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## BACKGROUND

Pain occurring in the coccygeal region is known as coccygodynia. The exact incidence of coccygodynia has not been reported.

The etiology in most cases is trauma (acute or fracture nonunion). Other causes may be oncologic, infections, or idiopathic pain of unknown origin.

Due to under-diagnosis, these patients may suffer for years without proper treatment.

The first line of treatment is various methods of nonsurgical treatment.

Coccygectomy surgery is reserved for refractory cases.

Surgery was once associated with high complication rate and variable effectiveness, but more recently studies have reported good or excellent results after coccygectomy.

## METHODS

A review of the surgical technique for coccygectomy, and a presentation of a number of recent cases.

Coccygectomy is a surgical procedure in which the coccyx is removed. This surgery is recommended if patients fail to respond to non-operative treatment.

Different types of surgical techniques have been described, with the coccyx removed either totally or partially.

The three known surgical techniques described in the literature are:

1. Key's technique- most popular, using a small midline vertical incision from the sacrum to the tip of the coccyx,

2. "Z" Plasty technique-utilizing a vertical midline incision directly over the coccyx, Dissection is carried and the coccyx amputated. At the time of closure, the vertical incision is extended in the shape of a "Z"

3. Paramedian approach, a 3 cm left paramedian incision is made alongside the intergluteal cleft approximately 2-3 cm above the anus. The dissection is then taken to the midline of the coccyx in the sub-periosteal plane so as to obtain direct access dorsally.

## RESULTS

Coccygectomy is a safe treatment option in patients who failed conservative treatment for coccygodynia, and shows excellent long-term results. No patient had recurrent onset of coccygodynia following surgery.

## CONCLUSION

Coccygectomy for chronic coccygodynia is an effective treatment option with high success and low complication rate.

# PEDIATRIC SPINAL CORD INJURY, EPIDEMIOLOGY AND OUTCOME

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## INTRODUCTION

Pediatric spinal cord injury (SCI) is a rare condition, with reported incidence of 26.9 per million children, as compared to pediatric cervical fractures, reported to have an incidence of 2.9% of all trauma injuries. Pediatric SCI is variable both in presentation and outcome. The literature is scant. We here present a series of children with pediatric SCI.

## MATERIAL AND METHODS

A retrospective review of the trauma registry of a level 1 trauma center between 2006-2017 was performed. All children (aged 0-18) with a SCI were collected. Demographic data, injury data including mechanism, injury severity score, additional injuries and level of spinal injury at time of arrival was obtained. Data on surgical and non-surgical intervention, length of hospital stay, discharge destination and long term follow up was extracted.

## RESULTS

30 children were identified with SCI. Most were male (24/30), mean age of 13.9. Mean ISS was 32.93. Mechanism of injury was MVA (17), contusion (5), fall from height (4), penetrating (3) and blast injury (1).The associated injuries were abdominal (17), chest wall and lung (24), brain (10). Fractures were noted in 23 cases (pelvic, skull, extremity), and vertebral fractures were noted in 17 children. Mean length of hospital stay was 23.77 days. level of injury was cervical in 21, thoracic 5, lumbar 4 in with initial ASIA scores of A in 11 (37.95%), B in 8 (27.59%), C in 4 (13.79%), D in 6 (20.69%). Latest ASIA score was A for 8.33%, B for 12.5%, C for 20.83%, D for 33.33% and E for 25%. Mean delta in ASIA score was 1.67 points, with significant improvement is 8 children. The mean follow-up is 26 months, obtainable for 26 patients.

## CONCLUSION

spinal cord injury is a rare and grave condition, it is rarely an isolated condition, and usually presents with multiple injuries. The recovery course is long but in many of the children an improvement can be seen.

# AWAKE PERCUTANEOUS FIXATION FOR UNSTABLE FRACTURES OF THE SPINE IN HIGH RISK PATIENTS – A RETROSPECTIVE STUDY

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## ABSTRACT

Unstable fractures in sick or elderly patients are on the rise. These patients who are borderline for surgery, present a challenge for surgeons as the risks involved in general anesthesia and surgery may overpower the benefit from surgery. In patients with ASIA 4 the risk is even higher as they may die during surgery. In light of these risks new methods for the treatment of such fractures has to be developed.

## METHODS

All patients who were ASIA 3-4 who presented with unstable fractures of the spine, were admitted to a level one trauma center, the patients underwent awake spinal percutaneous fixation, with mild sedation and local anesthesia in an angiography room. Demographics, radiology, and outcome were collected.

## RESULTS

Eighteen patients were operated between the years 2019-2020. Average follow up was 8 months (range 4-20 months) 6 were female and 12 male. The average age was 72, the ASIA score was 3-4 to all patients. There were 11 extension type injuries and 7 unstable burst injuries. All patients underwent unilateral fixation with cement augmentation in 15 of the patients. There were no neurological complication. There was one case of infection that presented 4 months after surgery. All patients were discharged in an ambulatory setting.

## CONCLUSIONS

Awake fixation in extreme cases is safe and feasible, a dedicated team including an anesthesiologist and radiologist is needed to perform these cases safely and quickly.

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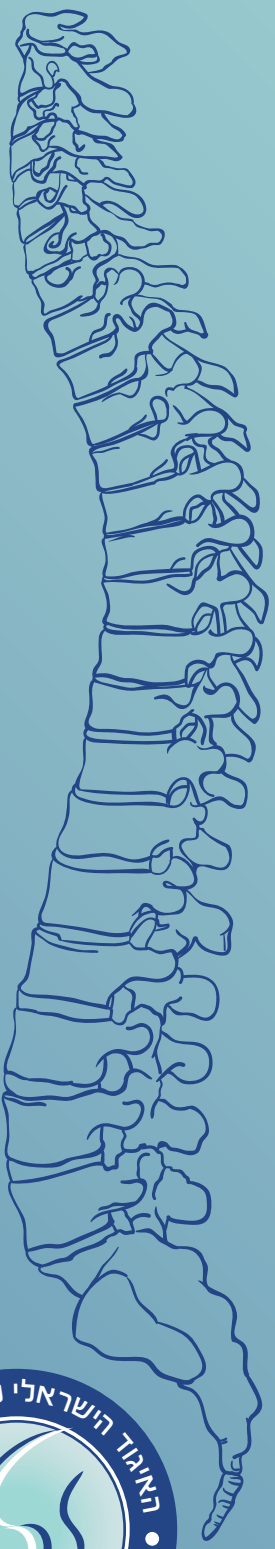

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